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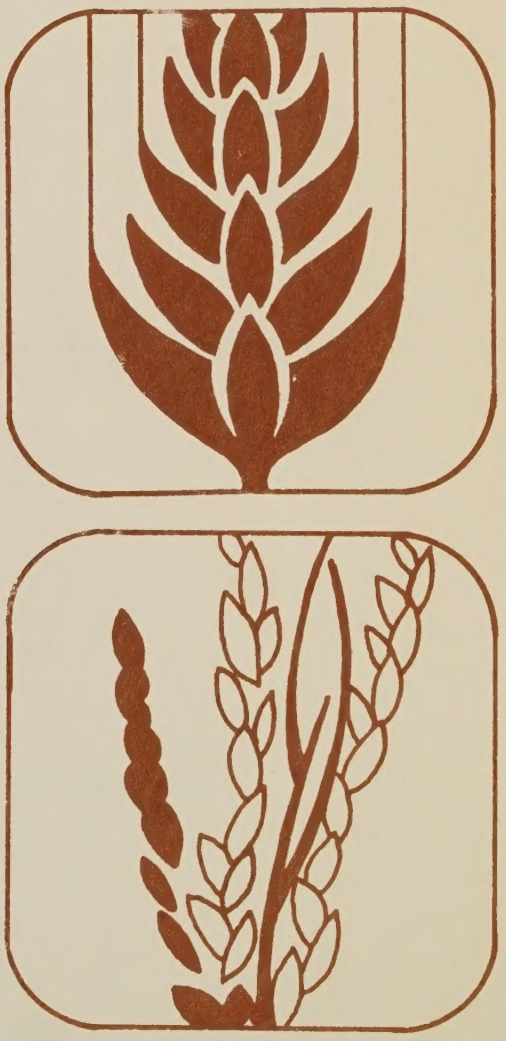
FOREIGN ECONOMIC DEVELOPMENT REPORT NO.8

Imports and Plantings of HIGH-YIELDING VARIETIES OF WHEAT AND RICE in the Less Developed Nations



FOREIGN ECONOMIC DEVELOPMENT SERVICE •
U.S. DEPARTMENT OF AGRICULTURE IN COOPERATION WITH
U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

ABSTRACT

The use of high-yielding varieties of wheat and rice has expanded sharply in recent years. The purpose of this bulletin is to provide statistical data on imports of seed and area planted in individual nations. There is no one standard definition of high-yielding varieties; this report refers largely to the dwarf and semi-dwarf types of wheat and rice developed, respectively, in Mexico and the Philippines.

Area estimates for free world nations may be summarized as follows (the 1969/70 data are preliminary):

Crop Year	Wheat	Rice	Total
		-- acres --	
1965/66	23,000	18,000	41,000
1966/67	1,542,000	2,505,000	4,047,000
1967/68	10,173,000	6,487,000	16,660,000
1968/69	19,699,000	11,620,000	31,319,000
1969/70	24,664,000	19,250,000	43,914,000

Most of the wheat and all of the reported rice area was in South and East Asia; of the 1969/70 total, 59% was in India and 20% in Pakistan. Limited areas of wheat have been planted in West Asia, North Africa, and Latin America.

In addition to presenting statistical data and accompanying documentation, the report briefly reviews the development of the major wheat and rice varieties. A discussion of rice improvement in three Communist nations is also included.

KEY WORDS: Wheat, Rice, Green revolution, Seed, Imports (seed), Crop statistics data, Research and development, Asia, Developing nations.

IMPORTS AND PLANTINGS OF HIGH-YIELDING VARIETIES OF WHEAT AND RICE IN THE LESS DEVELOPED NATIONS

by

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PREFACE

This bulletin is an enlarged and updated version of a report of the same title published in November 1969.

The main changes in the narrative involved (a) rewriting Chapter I, (b) moving the former Appendix section on the origin of the varieties to the front as Chapter II (and rewriting the portion on rice), and (c) writing a new appendix on rice improvement in several Communist nations.

The data represent information in hand as of January 14, 1971. Estimates for the 1969/70 crop year are in some cases preliminary and subject to revision. A few scattered projections for 1970/71 are included.

The revision has benefited from material which was provided by many individuals, including AID and USDA field personnel. Drs. Randolph Barker and T.T. Chang of IRRI have been of particular assistance.

NOTE

Area conversions on basis of 1 hectare = 2.471 acres.

CONTENTS

I. INTRODUCTION

The use of new high-yielding varieties of wheat and rice was expanded sharply in the less developed world in recent years. The purpose of this bulletin is to document as completely as possible the quantitative growth in cultivation of these varieties. It reports tonnage of seed imported and area planted or harvested. 1/

The report basically consists of three sets of tables for the non-Communist nations. The first two indicate imports and area planted by country and crop year for wheat and rice; each is followed by an extensive set of footnotes and references. The third set of tables summarizes the area information.

The tables are preceded by a discussion of the origin of high-yielding wheat and rice varieties and followed by an appendix which reviews the development of improved rice varieties in Communist nations (Mainland China, North Korea, and Cuba).

A. Definitions

There is no one commonly accepted definition of high-yielding varieties of wheat and rice. In this bulletin we will primarily be concerned with (a) dwarf and semi-dwarf varieties developed at the International Wheat and Maize Improvement Center (CIMMYT) in Mexico and the International Rice Research Institute (IRRI) in the Philippines, and (b) direct descendants of these varieties developed in national breeding programs.

This definition is not without its limitations. First, it does not include all high-yielding varieties. Secondly, the varieties reported are not high-yielding under all conditions. Thirdly, the area of such varieties is not always reported separately. Fourthly, it is difficult to keep the Mexican or IRRI lineage straight. Finally, these varieties have been inadvertently mixed with local varieties in some nations and may have lost part of their high output potential.

The result is that the data reported here may not fit everyone's definition of high-yielding varieties.2/ The national data presented are

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1/ For a more analytical discussion of the new varieties, see: Dana G. Dalrymple, Technological Change in Agriculture: Effects and Implications for Developing Nations, U.S. Department of Agriculture, Foreign Agricultural Service, April 1969, pp. 35-51; Joseph W. Willett, The Impact of New Grain Varieties in Asia, U.S. Department of Agriculture, Economic Research Service, ERS-Foreign 275, July 1969, 26 pp.; Lester R. Brown, Seeds of Change, Praeger, 1970, 205 pp.; and Walter P. Falcon, "The Green Revolution: Generations of Problems," American Journal of Agricultural Economics, December 1970.

2/ In a recent FAO report, many of the locally developed varieties were placed in an "intermediate yielding" category. This approach has promise, but suffers from some of the same limitations: (1) the yields from the local varieties may not be markedly different, (2) as the inter-

usually -- but not always -- limited to the Mexican and IRRI varieties and descendants. The most important known exception is the rice information for India: the government data include, without breakdown, the area planted to two other major types of improved rice (ADT-27 and Taichung Native 1). 3/ Some sister varieties are included in the Malaysian figures.4/ Similarly, the Philippine data include two improved series of rice recently developed by government agencies (the BPI series and the C series).5/ Where the exact varietal composition is known, it is presented in the footnotes.

On the other hand, some improved varieties which might be considered high-yielding, but which have been in use for some time, are excluded. Major examples are (a) wheat in Mexico itself and in some other Latin American nations,6/ and (b) certain rice varieties in Taiwan (the ponlai series), 7/ and Ceylon (the H series). 8/

(cont'd)
national stock is used for local breeding, it is difficult to tell when it moves from one category to another, and (3) the production data may not be reported separately.

3/ ADT-27 was the best known product of a joint program conducted by the Indian Council of Agricultural Research and the Food and Agriculture Organization (for background, see Gove Hambidge, The Story of FAO, Van Nostrand, 1955, pp. 145-148). Taichung (Native) 1 came from Taiwan.

4/ Mashuri and Malinja originally came from the same program that produced ADT-27; they were further developed in Malaysia.

5/ The BPI series (which includes BPI-76) was developed by the Bureau of Plant Industry of the Philippine Government, the C series (C4-63, C4-113) was developed by the College of Agriculture of the University of the Philippines. Both series are reported separately by one Philippine agency, though not by another. There is some question whether the yields of BPI-76 justify its inclusion as a high-yielding variety.

6/ The proportion of wheat area planted to high-yielding varieties in Mexico went over 90% in 1967; the improved wheat area from 1960 to 1965 averaged from 1.8 to 1.9 million acres (Dana G. Dalrymple,"New Cereal Varieties: Wheat and Corn in Mexico," Spring Review, AID, July 1969, 32 pp.). Background on the early work in Mexico and other Latin American nations is provided by E.C. Stakman, et al., in Campaigns Against Hunger, Belknap Press, Cambridge, 1967, pp. 216-272.

7/ The Japanese initiated rice breeding work in Taiwan early in the century (see the article by S. C. Hsieh and V. W. Ruttan in Food Research Institute Studies, 1967 (no. 3), pp. 331-333).

8/ The leading local variety is H-4, which was developed in the early 1950's. (see N. Bandaranaike, "Ceylon," Regional Seminar on Agriculture: Papers and Proceedings, Asian Development Bank, Manila, 1969, p. 134).

B. The Data

The data on imports and area generally come from different sources. Most are unpublished.

The seed figures are believed to be relatively accurate, but incomplete (especially for exports from Mexico). 9/ Virtually all of the statistics on Philippine exports of rice were provided by Dr. Randolph Barker of IRRI. 10 In a few cases, the import figure represents an authorization rather than an actual shipment; such figures are placed in parentheses. 11/

The area information is largely based on reports submitted by AID country missions or U.S. agricultural attaches. These data, in turn, were often obtained from official reports or estimates by the countries themselves. There is no way of knowing how accurate the figures are and therefore they should be regarded as only approximate. While most of the figures refer to plantings, harvested area is reported in a few cases. The scattered figures for 1970/71 represent goals and are placed in parentheses.

For each import and area figure, a footnote is usually provided and a reference is always included. They are listed on the pages following the table. The footnote usually includes information on varietal breakdown. The footnotes are listed first and are indicated by _/; the references are marked by parentheses ( ). Those who intend to cite country figures are strongly urged to refer to both.

In addition to the countries reported as importing or planting new varieties, many others have them under test. And some of these nations, though not recorded here, may have moved into commercial production. 12/

9/ The data, however, may not always be assigned to the correct crop year. Where possible the date of shipment is reported.

10/ In the case of rice, only shipments of 0.1 metric ton or more are included. Where the seed was purchased directly from IRRI, this is so indicated in the footnotes; otherwise, seed was purchased from commercial sources in the Philippines.

11/ This applies where a nation has requested seed from India or Pakistan (countries receiving PL 480 grain generally are not allowed to export same or like commodities without prior authorization by the U.S.).

12/ This is a particular possibility for rice in Thailand. Several varieties have recently been developed utilizing IRRI stock or crosses (and are reported in recent issues of the Thai Journal of Agricultural Science). One guess is that perhaps 400,000 acres of new varieties were planted in the 1970 wet season, but official statistics may not be available for some time (letter from Delane Welsch, The Rockefeller Foundation, Bangkok, October 17, 1970).

II. ORIGIN OF HIGH-YIELDING VARIETIES

The origin of the varieties reported in this bulletin is considerably more involved than their classification as Mexican wheats and IRRI rice varieties might suggest.

A. Wheat

The Mexican wheat varieties discussed here are descendants of both Japanese and American varieties and breeding efforts.

Japan has had a long history in the development of dwarf wheat. In 1873, Horace Capron, former U.S. Commissioner of Agriculture who headed a mission to Japan, wrote that "the Japanese farmers have brought the art of dwarfing to perfection." He noted that "the wheat stalk seldom grows higher than 2 feet, and often not more than 20 inches." The head was short but heavy. The Japanese claimed that the straw had been so shortened "that no matter how much manure is used it will not grow longer, but rather the length of the wheat-head is increased." Capron noted that "on the richest soils and with the heaviest yields, the wheat-stalks never fall down and lodge." 1/

The Japanese crossed one such variety, Daruma, with a strain of the American soft red winter variety, Fultz, in 1917. The cross eventually produced a strain known as Fultz-Daruma. This strain was in turn crossed with the American hard red winter variety Turkey Red in 1924 and led to a number of different types. One of these was later known as Norin 10; it was registered and released to Japanese farmers in 1935. 2/

In 1946, Dr. S. C. Salmon, a U. S. Department of Agriculture scientist who was Agricultural Advisor to the Occupation Army in Japan, noted Norin 10 growing at a research station. The stems were short, but the heads were full sized. Dr. Salmon brought seed back to the United States in 1946. 3/

1/ Horace Capron, "Agriculture in Japan," Report of the Commissioner of Agriculture for the Year 1873, Washington, 1874, p. 369.

2/ L. P. Reitz and S. C. Salmon, "Origin, History, and the Use of Norin 10 Wheat," Crop Science, November-December 1969 (Vol. 8, No. 6), pp. 686-689. It is not known exactly how Fultz and Turkey Red got to Japan, but Fultz arrived before 1892. Fultz was first selected in Pennsylvania in 1862 and could have been introduced by the Capron Mission during the early 1870's. Turkey Red, better known as Turkey, was introduced in Kansas in 1873 by a group of Russian Mennonites; it later became the leading U. S. variety. For details on Fultz and Turkey, see J. A. Clark et al., Classification of American Wheat Varieties, U. S. Department of Agriculture, Bulletin No. 1074, November 1922, pp. 83-85, 144-147.

3/ Reitz and Salmon, op. cit., p. 687.

Although Norin 10 was not satisfactory for direct use outside of Japan, it was useful for cross breeding. Dr. O. A. Vogel of the U.S. Department of Agriculture was the first to use it in his cooperative breeding programs at Washington State University. While this work was in progress, Dr. Norman E. Borlaug of the Rockefeller Foundation obtained some of the early crosses in 1953 for his breeding work in Mexico. These lines were crossed with Mexican, Colombian and other wheats, and a series of spring wheat varieties were produced, including Lerma Rojo, May 64, Penjamo 62, Pitic 62, Sonora 63, and Sonora 64. 4/

While no attempt is made here to trace out all the "Mexican" varieties presently in use in other nations, India provides an interesting example of the changes that have taken place. 5/ In 1963, Dr. Borlaug sent 100 kg. (220 lbs.) of several Mexican varieties to India; included were Mayo 64, Sonora 63, Sonora 64, Lerma Rojo 64, and line 8156. In the summers of 1965 and 1966, large quantities of Sonora 64 and Lerma Rojo seed -- both with a red grain -- were imported from Mexico and were widely planted. Meanwhile, breeding work continued in India using line 8156; in 1967 three amber grained strains were released: Kalyan Sona, 6/ Sonalika, and Chotti Lerma (S. 331). Also, amber strains of Sonora 64 and Lerma Rojo 64 have been developed; they are known respectively as Sharbati Sonora and Safed Lerma. By November 1969, the Indian Planning Commission was able to report that "the pure Mexican varieties introduced earlier had been practically replaced." 7/

4/ L. P. Reitz, "Short Wheats Stand Tall," 1968 Yearbook of Agriculture, U. S. Department of Agriculture, pp. 236-237. Also see L. P. Reitz, "New Wheats and Social Progress," Science, September 4, 1970, pp. 952-955; and Don Paarlberg, Norman Borlaug - Hunger Fighter, U. S. Department of Agriculture, PA 969, December 1970, 20 pp.

5/ Developed from information provided in: Carroll P. Streeter, A Partnership to Improve Food Production in India, The Rockefeller Foundation, 1969 or 1970, pp. 12-17; letter from James H. Boulware, Agricultural Attache, American Embassy, New Delhi, June 12, 1970.

6/ Sister varieties of Kalyan Sona in wide use in other nations include Siete Cerros and Super X (red) in Mexico, Mexipak in Pakistan, and Espigas in Turkey.

7/ Evaluation study of High Yielding Varieties Programme, Report for the Rabi 1968-69 - Wheat, Paddy and Jowar, Government of India, Planning Commission, Program Evaluation Organization, p. ii. The report indicated that Kalyan Sona was the most important variety, accounting for about one-fourth of production (p. 49).

B. Rice 8/

There are two major groups of rice varieties: Indica and Japonica. 9/

- Indica is the major group grown throughout South and Southeast Asia and in most areas of China. The majority of Indica varieties raised in the monsoon tropics have evolved from combined natural and human selection processes. They are well adapted to conditions of low soil fertility, uncertain weather, and poor water control. Most Indicas have resistance to endemic diseases and insects, and compete well with weeds. They also have the dry cooking characteristics preferred by consumers in tropical and sub-tropical areas. But the features that enable the tropical types of Indicas to survive -- tall and high tillering plants, late maturity, long drooping leaves, etc. -- also provide the basis for their weakness under modern agricultural practices. Improved fertilization, for instance, will lead mainly to vegetative growth and lodging rather than a significantly increased yield.

- Japonica varieties are widely distributed in different areas of the temperate zone. The varieties evolved more recently than the Indicas and are the result of an intensive human selection process. In comparison with the Indicas, they have darker and more upright leaves, a shorter and stiffer stalk, earlier maturity, and a more thrifty vegetative growth. Japonicas respond well to improved cultural practices -- especially fertilizer -- and are more resistant to lodging. As a result, yields are considerably higher than for the Indicas. Japonicas are not, however, well adapted for the traditional cultural practices in tropical Asia: among other things, (1) the varieties require precise control of water, weeds, and insect pests, (2) most are susceptible to the virus diseases of the tropics, (3) some react to the high temperature during early growth stage by flowering too early, (4) they lack the grain dormancy needed in the monsoon season, and (5) the grains have a sticky cooking quality which is not desired by consumers.

Attempts have been made over the course of many years to improve both types of rice for use in the tropics:

- Japonica. Research work on this group was initiated in Japan nearly 70 years ago. Successes were obtained in breeding more nitrogen-responsive and disease-resistant types. 10/ A breeding program to develop daylength- and temperature-insensitive types was initiated in Taiwan

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8/ Dr. T. T. Chang, Geneticist, Varietal Improvement Department, International Rice Research Institute, kindly reviewed earlier drafts of this section and provided much helpful information.

9/ Background on this classification may be found in Takane Matsuo, Rice and Rice Cultivation in Japan, Institute of Asian Economic Affairs, Tokyo, 1961, pp. 9-25.

10/ Ibid., pp. 20-27, 91-93.

in the early 1920's and resulted in the ponlai varieties (such as Taichung 65). 11/ These varieties made possible the stable double cropping of rice, using a single variety for both crops. 12/ Between 1925 and 1940, 50% of the rice land in Taiwan was shifted to the ponlai varieties. 13/ Subsequent research verified their high-yielding ability over a wide area in tropical Asia and Africa. 14/ But the ponlais did not gain wide commercial acceptance because of disease problems and grain features.

- Japonica x Indica Crosses. The FAO-India program noted earlier in this bulletin (p. 2, fn. 3) was an attempt to cross Japonica and Indica varieties. Results were generally not satisfactory because nearly all of the Japonica parents were from Japan and were poorly adapted to a tropical climate. But one hybrid, ADT-27, did show a substantial improvement over local varieties and subsequently was widely planted in the Tanjore district. This breeding program also produced a few other varieties. One, Mahsuri (from a cross between Taichung 65 and Mayang Ebos 80), was further developed in Malysia with Japanese assistance and is now extensively planted. 15/

- Indica. Attempts to improve Indica varieties in the 1950's were fairly successful. Results of this work include H-4 in Ceylon, BPI-76 and C4-63 in the Philippines, and Peta and Bengawan in Indonesia.

Taichung Native 1 (TN-1) was developed in Taiwan after World War II by crossing Dee-geo-woo-gen, a short variety which is thought to have come from Fukien Province in southern China several hundred years before, 16/ with a tall drought-resistant local variety. It was the first Indica to

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11/ Several of the ponlai varieties included an Indica in their parentage. Details on the development of ponlai varieties are provided in E. Iso, Rice and Crops in Its Rotation in Subtropical Zones, Japan FAO Association, Tokyo, 1954, pp. 106-137.

12/ Letter from Chang, op. cit., October 26, 1970.

13/ Hsieh and Ruttan, op. cit., p. 331. (See fn. 7 on p. 2 of this report.)

14/ T. T. Chang, "The Genetic Basis of Wide Adaptability and Yielding Ability of Rice Varieties in the Tropics," International Rice Commission Newsletter, December 1967, pp. 4-15.

15/ Malinja, another variety developed in the same program and planted in Malaysia, represents a cross between two Indicas, Siam 29 and Pebifun. Pebifun originally came from Taiwan where it was once a leading variety. (Letter from Chang, op. cit., October 27, 1970.)

16/ Noted in T. S. Miu (ed.), A Photographic Monograph of Rice Varieties of Taiwan, Taiwan Agricultural Research Institute, Special Publication No. 2, December 30, 1959, p. 67. (Reference provided by C. Roy Adair of the Agricultural Research Service, USDA.)

respond as well or better to fertilization than the ponlais. 17/ TN-1 had its major impact on rice production in India. Jaya, a new Indian variety, represents a cross of TN-1 and T. 141, a tall Indian variety from Orissa. Padma, another new Indian variety, came from the same cross, but matures earlier than TN-1. 18/

The IR series was, of course, developed at the International Rice Research Institute in the Philippines. IR-8 was obtained by crossing Peta (the tall Indonesian variety noted above) with Dee-geo-woo-gen (the short Chinese variety noted above as one of the parents of TN-1). The first cross was made in 1962 and the variety was released in November 1966. 19/ IR-5 was developed concurrently from a cross between Peta and Tangkai Rotan, a Malaysian variety (hence IR-5 does not have the same Chinese dwarf gene as IR-8 but is of moderately short height); it was announced in December 1967. 20/ IR-20 was selected from a cross, also made in 1965, between IR262-24-3 (a descendant of a cross between Peta and TN-1) and TKM-6, an Indian variety. IR-22 was selected from a cross, also made in 1965, between IR-8 and Tadukan, a Philippine variety. Both IR-20 and IR-22 were released in December 1969. 21/

17/ See T. T. Chang, Recent Advances in Rice Breeding in Taiwan, Joint Commission on Rural Reconstruction, Plant Industry Series 22, 1961, pp. 33-58.

18/ S. V. S. Shastry, "New High-Yielding Varieties of Rice: Jaya and Padma," Indian Farming, February 1969, pp. 5-13; Streeter, op. cit., pp. 26, 28.

19/ For details, see Robert F. Chandler, "Dwarf Rice - A Giant in Tropical Asia," 1968 Yearbook of Agriculture, pp. 252-255; Streeter, op. cit., pp. 26-29.

20/ Further information on IR-5, including a specific comparison with IR-8 is provided in "IR-5 - A New High-Yielding IRRI Variety," The IRRI Reporter, January 1968, 4 pp.

21/ Additional information, including a detailed comparison with IR-8 and IR-5, is found in "IR-20 and IR-22, New Rice Varieties," The IRRI Reporter, January 1970, 4 pp.

III. HIGH-YIELDING VARIETIES OF WHEAT

A. IMPORTS AND AREA

Country and Crop Year	Quantity of Seed Imported	Area Planted or Harvested
	- metric tons -	- acres -
SOUTH ASIA		
Afghanistan		
1965/66	50 1/ (1)	4,500 3/ (4)
1966/67	420 2/ (2)(3)	54,400 (5)
1967/68		301,500 (5)
1968/69		360,800 (6)
1969/70		
India */		
1965/66	250 1/ (1)(2)	7,400 (3)
1966/67	18,000 2/ (1)(2)	1,270,000 3/ (4)
1967/68		7,270,000 4/ (4)
1968/69		11,844,000 5/ (4)
1969/70		15,100,000 6/ (5)
Nepal		
1965/66		3,500 3/ (1)
1966/67	38 1/ (1)	16,200 4/ (1)
1967/68	450 2/ (1)	61,300 5/ (1)
1968/69		133,000 6/ (2)
1969/70		186,500 (3)
Pakistan, East		
1968/69		20,000 (1)
1969/70		NA
Pakistan, West		
1965/66	350 1/ (1)(2)	12,000 (1)
1966/67	50 2/ (1)(2)	250,000 (1)
1967/68	42,000 3/ (1)(2)	2,365,000 (4)
1968/69		5,900,000 (5)
1969/70		7,000,000 4/ (6)
EAST ASIA		
Burma		
1968/69	2 1/ (1)	
1969/70	302 2/ (1)(2)	
WEST ASIA		
Iran		
1968/69	1,500 1/ (1)	25,000 3/ (3)
1970/71	4,000 2/ (2)	222,400 4/ (4)
Iraq		
1968/69	800 1/ (1)	
Jordan		230 1/ (1)
1968/69		- 2/ (2)
1969/70		

Country and Crop Year	Quantity of Seed Imported	Area Planted or Harvested
	- metric tons -	- acres -
WEST ASIA (cont'd)		
Lebanon		
1968/69		690 1/
1969/70		4,200 1/2/(1)
Saudi Arabia		
1969/70	2 1/ (1)	
Syria		
1969/70	(200) 1/ (1)	
Turkey		
1966/67	60 1/ (1)	1,500 (3)
1967/68	22,100 2/ (2)	420,000 (2)
1968/69		1,430,000 (4)
1969/70		1,540,000 3/ (4)
AFRICA		
Algeria		
1969/70	1,500 1/ (1)	12,400 3/ (1)
1970/71	(10) 2/ (2)	
Egypt (UAR)		
1970/71	(1) 1/ (1)	
Morocco		
1967/68	1 1/ (1)	500 (2)
1968/69	500 2/ (3)(4)	12,100 3/ (3)
1969/70		98,800 4/ (5)
Sudan		
1969/70	(1) 1/ (1)	
1970/71	(5) 2/ (2)	
Tanzania		
1969/70	3 1/ (1)	
Tunisia		
1967/68	50 (1)	2,000 1/ (2)
1968/69		32,000 2/ (2)
1969/70		131,000 (3)
Zambia		
1969/70	0.2 (1)	
LATIN AMERICA		
Bolivia		
1968/69	50 (1)	
Guatemala		
1969/70		7,400 1/ (1)

B. FOOTNOTES

SOUTH ASIA

Afghanistan

1/ Lerma Rojo 64A. Imported from Mexico in 1965.

2/ Lerma Rojo 64: 250 tons from Mexico (ref. 2), and 170 tons from Pakistan (ref. 3).

3/ Of this total, nearly 2,000 acres were Lerma Rojo 64A and 1,900 Tascosa.

India

* See Chapter II (wheat), last paragraph, for a discussion of the evolution of Mexican varieties in India.

1/ 200 tons of Sonora 64 and 50 tons of Lerma Rojo 64.

2/ Mostly Lerma Rojo 64; remainder Sonora 64.

3/ Of this, 71% was in Uttar Pradesh, 12% in the Punjab, and 17% elsewhere.

4/ Of this, 54% was in Uttar Pradesh, 22% in the Punjab, and 24% elsewhere.

5/ Of this, 52% was in Uttar Pradesh, 25% in the Punjab, and 23% elsewhere.

6/ Unofficial earlier estimates were about 12.6 million acres (ref. 6).

Nepal

1/ Lerma Rojo. Imported from Mexico by India.

2/ Lerma Rojo. From India.

3/ Lerma 52.

4/ 14,800 acres of Lerma 52; 1,400 of Lerma Rojo.

5/ 31,600 acres of Lerma 52; 29,700 of Lerma Rojo.

6/ All improved wheat planted; mainly Mexican varieties. Estimate; exact area not certain.

Pakistan, East

1/ Unofficial estimate.

Footnotes (cont'd)

SOUTH ASIA (cont'd)

Pakistan, West

1/ 250 tons of Penjamo 62 and 100 tons of Lerma Rojo 64.

2/ Mostly Mexipak 65 (white) (Siete Cerros); some Mexipak Red (Indus 66). In addition, 20 tons were available locally.

3/ 40,000 tons of Mexipak Red (Indus 66) and 2,000 tons of Mexipak 65 (Siete Cerros).

4/ Unofficial estimate; official estimate not available at press time.

EAST ASIA

Burma

1/ Shipped from West Pakistan in September 1968.

2/ Of total, 300 tons shipped from West Pakistan in September 1969; 1.5 tons shipped from India during July-September 1969 period (1 ton of Kalyan Sona; 0.5 ton of Sharbati Sonora).

WEST ASIA

Iran

1/ Penjamo 62 imported from Turkey.

2/ About 2,500 tons of Bezostaya No. 1 from USSR and 1,500 tons of Mexican Inya 66 from Denmark.

3/ "About 10,000 hectares;" Penjamo 62.

4/ Mexican type wheat.

Iraq

1/ Shipped from West Pakistan, September 1968.

Jordan

1/ "Improved" wheat varieties.

2/ Plantings disrupted due to hostilities; possibly an experimental acre or two were planted.

Lebanon

1/ Mexipak.

2/ Based on seed sold.

Footnotes (cont'd)

WEST ASIA (con'd)

Saudi Arabia and Syria

1/ Gift from West Pakistan.

Turkey

1/ Sonora 64.

2/ Only 17,000 tons planted in fall; remainder planted in spring 1968. Included: 6,190 tons of Lerma Rojo 64; 6,950 of Penjamo 62; and 5,860 of Super X.

3/ A Russian wheat variety, Bezostaya, was experimentally planted in the Anatolian Plateau and reportedly did very well. It is expected to be widely planted in the plateau during the 1970/71 season (refs. 4 & 5).

AFRICA

Algeria

1/ Imported from Mexico.

2/ Authorization for West Pakistan to export 10 tons of Mexipak seed to Algeria (to leave July 1970).

3/ Rough estimate.

Egypt

1/ Authorization for West Pakistan to export 1 ton of seed.

Morocco

1/ Siete Cerros (plus 150 kg. of Super X).

2/ Included 250 tons of Siete Cerros, 100 of Inia 66, 100 of Tobari 66, 25 of Penjamo 62, and 25 of Norteno.

3/ 50% Siete Cerros; rest Inia 66, Tobari 66, and Penjamo 62 (ref. 6).

4/ Included 10,000 acres of Mexican varieties and 30,000 of Italian semi-dwarf.

Sudan

1/ Gift from West Pakistan; shipped September 1969.

2/ Authorization for West Pakistan to export 5 tons of Mexipak seed to Sudan.

Footnotes (cont'd)

AFRICA (cont'd)

Tanzania

1/ Gift from West Pakistan; shipped June 1969.

Tunisia

1/ "Nearly 2,000 acres."

2/ 35% Inia 66, 35% Tobari 66, 15% Jarral, and 15% Sonora 63 (ref. 3).

Zambia

1/ Gift of 412 lbs. of Mexipak from West Pakistan; shipped September 1969.

LATIN AMERICA

Bolivia

1/ 25 tons of each of two varieties. (Type not stated, but Jaral 66 and Norteno 67 previously tested.)

Guatemala

1/ Includes local varieties developed from Mexican stock.

C. REFERENCES

SOUTH ASIA

Afghanistan

(1) "The Green Revolution," Participant Report, USAID, Kabul, Summer 1969, p. 2.

(2) Fourth Annual Wheat Seminar, August 28, 1969 - September 8, 1969, Ministry of Agriculture and Irrigation, Kabul, summary paper by Joe Motheral.

(3) CIMMYT Report, 1967-68, International Maize and Wheat Improvement Center (CIMMYT), Mexico City, pp. 59, 72.

(4) Agricultural Development in Afghanistan, with Special Emphasis on Wheat, U.S. Agricultural Review Team, July 1967, pp. 31-32.

(5) Department of State Airgram TOAID A-574 from Kabul, December 8, 1969, p. 8 (Table II).

(6) Letter from Joe R. Motheral, Food and Agriculture Officer, AID, Kabul, September 23, 1970.

India

(1) "Rice and Wheat in India," Spring Review (AID), March 10, 1969, p. 7.

(2) Five Years of Research on Dwarf Wheat, Indian Agricultural Research Institute, New Delhi, 1968, Preface; Grant Cannon, "On the Eve of Abundance," Farm Quarterly, Fall Forecast, 1967, pp. 89-90.

(3) 1966/67 CIMMYT Report, p. 67.

(4) "Report on Price Policy for Kharif Cereals for the 1970-71 Season," Agricultural Prices Commission, New Delhi, August 1970, p. 27.

(5) Foreign Agricultural Service Telegram TOFAS 84 from New Delhi, December 17, 1970.

(6) "The Green Revolution in India," USAID, New Delhi, August 12, 1970, p. 22.

Nepal

(1) Department of State Airgram TOAID A-404 from Kathmandu, February 16, 1968.

(2) Letter from Dale G. Strong, Food and Agriculture Division, AID, Kathmandu, September 12, 1969 (data from Agriculture Extension Department of Nepalese Government).

References (cont'd)

SOUTH ASIA (cont'd)

Nepal

(3) Department of State Telegram 4147 from Kathmandu, December 24, 1970.

Pakistan, East

(1) Foreign Agricultural Service Telegram TOFAS 96 from Rawalpindi, October 15, 1969.

Pakistan, West

(1) "Rice and Wheat in Pakistan," Spring Review (AID), March 17, 1969, pp. 3-5.

(2) 1966-67 CIMMYT Report, pp. 64-65; Cannon, op. cit., p. 90.

(3) "Annual Technical Report: Accelerated Wheat Improvement Program, West Pakistan, 1966-67," Government of West Pakistan (Agriculture Department, The Planning Cell), Lahore, July 1967, p. 11.

(4) "Country Field Submission: Pakistan, FY 1971," AID, August 1969, Appendix A, Table 1.

(5) Foreign Agricultural Service Report No. PK0003 from Rawalpindi, January 20, 1970, p. 4.

(6) Foreign Agricultural Service Telegram TOFAS 03 from Islamabad, January 6, 1971.

EAST ASIA

Burma

(1) Foreign Agricultural Service Aircomm from Rawalpindi to Program Compliance Division, Export Marketing Service, November 20, 1969.

(2) Foreign Agricultural Service Report No. IN0025 from New Delhi, February 19, 1970.

WEST ASIA

Iran

(1) Foreign Agricultural Service Reports from Tehran: IR-9003, January 20, 1969; IR-9006, February 5, 1969.

(2) Foreign Agricultural Service Report IR-0018 from Tehran, October 8, 1970.

References (cont'd)

WEST ASIA (cont'd)

Iran

(3) Foreign Agricultural Service Telegram TOFAS 60 from Tehran, October 25, 1969.

(4) Foreign Agricultural Service Telegram TOFAS 83 from Tehran, December 17, 1970.

Iraq

(1) Aircomm from Rawalpindi, op. cit., November 20, 1969.

Jordan

(1) Department of State Airgram TOAID A-363 from Amman, November 28, 1969, p. 3.

(2) Conversation with Robert Horton, Agriculture Branch, NESA/TECH, AID, Washington, December 16, 1970.

Lebanon

(1) Letter from William Horbaly, Agricultural Attache, American Embassy, Beirut, September 17, 1970.

Saudi Arabia and Syria

(1) Aircomm from Rawalpindi, op. cit., November 20, 1969.

Turkey

(1) 1966-67 CIMMYT Report, p. 69; Joseph R. Williams, "Wheat Program Leads Off Turkey's New 5-Year Plan," Foreign Agriculture, November 20, 1967, p. 5.

(2) "Wheat in Turkey," Spring Review (Airgram TOAID A-141 from Ankara, March 21, 1969), pp. 5-6, 12-13. (Also see L. M. Humphrey, Mexican Wheat Comes to Turkey, USAID, Food and Agriculture Division, Ankara, April 1969.)

(3) CIMMYT Report, 1967-68, p. 59.

(4) Letter from Harold R. Varney, Agricultural Attache, American Embassy, Ankara, September 21, 1970.

(5) "Soviet Wheat Gives Good Results in Eskisehir," Vatan (Ankara; in Turkish), June 8, 1970, p. 5 (JPRS 50917, No. 441, July 9, 1970).

References (cont'd)

AFRICA

Algeria

(1) Conversation with Dr. Gregorio Martinez V. of CIMMYT, December 17, 1970.

(2) Department of State Telegram 117861 to Rawalpindi, July 22, 1970.

Egypt

(1) Telegram 117861 to Rawalpindi, op. cit., July 22, 1970.

Morocco

(1) Department of State Airgram A-272 from Rabat, December 26, 1967.

(2) CIMMYT Report, 1967-68, p. 73.

(3) "Morocco: Wheat," Spring Review (AID), March 13, 1969, pp. 2, 4.

(4) "Moroccan Agriculture Thrives on High-Yield Mexican Wheat," Front Lines (AID), February 15, 1969, p. 3.

(5) Letter from Dudley G. Williams, Agricultural Attache, American Embassy, Rabat, October 9, 1970.

(6) CIMMYT Report, 1968-69, pp. 57, 97.

Sudan

(1) Aircomm from Rawalpindi, op. cit., November 20, 1969.

(2) Department of State Telegram 117861 to Rawalpindi, July 22, 1970.

Tanzania

(1) Aircomm from Rawalpindi, op. cit., November 20, 1969.

Tunisia

(1) "Tunisia to Close 'Wheat Gap'," Front Lines (AID), December 15, 1968, p. 7.

(2) Foreign Agricultural Service Report TN-9004 from Rabat, June 26, 1969.

(3) Letter from Williams, op. cit., October 9, 1970 (Morocco).

References (cont'd)

AFRICA (cont'd)

Zambia

(1) Aircomm from Rawalpindi, op. cit., November 20, 1969.

LATIN AMERICA

Bolivia

(1) Department of State Telegram 5196 from La Paz, June 21, 1968; Airgram A-802 from La Paz, July 3, 1968.

Guatemala

(1) Conversation with Martinez, op. cit., December 17, 1970.

IV. HIGH-YIELDING VARIETIES OF RICE

A. IMPORTS AND AREA

Country and Crop Year	Quantity of Seed Imported		Area Planted or Harvested	
	- metric tons -		- acres -	
SOUTH ASIA				
Ceylon				
1967/68	0.5	1/ (1)		
1968/69	211	2/ (1)	17,240	5/ (3)
1969/70	-	3/ (2)	65,100	6/ (4)(5)
1970/71	0.4	4/ (2)	-	7/ (5)
India				
1964/65	-	1/ (1)	200	8/ (4)
1965/66	6	2/ (1)	17,650	9/ (1)
1966/67	80	3/ (1)	2,195,000	10/ (5)
1967/68	20	4/ (2)	4,408,000	11/ (5)
1968/69	-	5/ (3)	6,625,000	12/ (5)
1969/70	-	6/ (3)	10,800,000	13/ (6)
1970/71	-	7/ (3)		
Nepal				
1968/69	0.6	1/ (1)	105,000	4/ (3)
1969/70	(60)	2/ (2)	123,000	(4)
1970/71	0.5	3/ (1)		
Pakistan, East				
1966/67	10	(1)	500	3/ (2)
1967/68	1,500	1/ (1)(2)	166,000	3/ (3)
1968/69			381,500	3/4/ (4)
1969/70	4.4		651,700	5/ (5)
1970/71	1,800	2/	(1,216,000)	6/ (5)
Pakistan, West				
1966/67	2	1/ (1)	200	3/ (2)
1967/68	77	2/ (1)	10,000	1/ (2)
1968/69			761,000	4/ (2)(3)
1969/70			1,239,000	(4)
1970/71				

Country and Crop Year	Quantity of Seed Imported	Area Planted or Harvested
	- metric tons -	- acres -
EAST ASIA		
Burma		
1966/67	0.1 1/ (1)	19 6/ (3)
1967/68	200 2/ (1)	8,500 6/ (3)
1968/69	- 3/ (2)	412,400 7/ (3)
1969/70	200 4/ (2)	355,900 8/ (3)
1970/71	100 5/ (2)	
Indonesia		
1966/67	0.2 1/ (1)	
1967/68		
1968/69	1 2/ (2)	488,400 4/5/ (4)
1969/70		(1,850,400) 4/6/ (4)
1970/71	- 3/ (3)	
Laos		
1966/67	0.1 1/ (1)	900 4/ (3)
1967/68		3,000 5/ (4)
1968/69	6 2/ (1)	5,000 6/ (4)
1969/70		4,940 7/ (5)
1970/71	10 3/ (2)	
Malaysia (West)		
1966/67	3 1/ (1)	104,450 4/ 5/ (3)
1967/68	3 2/ (1)	156,950 4/ 6/ (3)
1968/69		224,650 4/ 7/ (3)
1969/70		316,000 4/ 8/
1970/71	- 3/ (2)	
Philippines		
1966/67	55.3 1/ (1)	204,100 (3)
1967/68	6.1 2/ (1)	1,733,400 6/ (4)
1968/69	18.2 3/ (1)	2,500,000 7/
1969/70	- 4/ (2)	3,345,600 8/ (5)
1970/71	34.4 5/ (2)	
Vietnam (South)		
1967/68	45 1/ (1)	1,200 5/ (1)
1968/69	2,005 2/ (1)	100,000 6/ (4)
1969/70	0.1 3/ (2)	498,000 (4)
1970/71	1.0 4/ (3)	(1,100,000) 7/ (5)

PHILIPPINE AND IRRI EXPORTS OF HIGH-YIELDING RICE SEED TO COUNTRIES WHERE NO PLANTED AREA DATA ARE REPORTED. METRIC TONS

	1967	1968				1969			1970				
	IR-8	IR-8	IR-5	C4-63	C4-113	IR-8	IR-5	C4-113	IR-8	IR-5	IR-20	IR-22	C4-63
WEST ASIA													
Iran		#											
Iraq						100#							
UAR	100#1/												
Saudi Arabia		*											
Turkey		*	*			*							
						*	*		*	*	0.1*	0.7*	
AFRICA													
Ghana				2						*	*	*	
Ivory Coast		*	*									0.5*	
Liberia		1#	1#	1#								#	
		*											
LATIN AMERICA													
Colombia			*									*	
Ecuador			#			2.2#	#						
El Salvador												0.2*	
Nicaragua											*	0.3*	
Panama	10#	10*	#		#	#	#	#			33.5#	2#	33.5#
Venezuela		10#											

From commercial sources in Philippines; where used by itself indicates less than 1.0 metric ton.
* From International Rice Research Institute; where used by itself indicates less than 0.1 metric ton.
1/ A special effort was made to determine what became of this seed, but no information has been obtained to date.

Source: Data provided by Dr. Randolph Barker, IRRI, October 23, 1970.

B. FOOTNOTES

SOUTH ASIA

Ceylon

1/ IR-8 (from IRRI).

2/ IR-8. In 1968, 210 tons of IR-8 were imported from Philippines and 0.90 tons (0.45 IR-8 and 0.45 IR-5) from IRRI.

3/ In 1969, less than 0.1 ton of IR-20 was imported from IRRI.

4/ In 1970, less than 0.1 ton of IR-20 and 0.35 ton of IR-22 was imported from IRRI.

5/ IR-8. Of the total, 1,131 acres were planted in yala (summer) 1968 and 16,107 in maha (winter) 1968/69. In addition, the following areas were planted to other improved varieties: H (or hybrid) series 1,020,000 acres; A-8 (a local pureline) 15,500; PTB (an Indian hybrid) 2,300.

6/ IR-8. Of the total, 10,000 acres were planted in Yala 1969 and 55,100 in maha 1969/70. In addition, the following areas were planted to other improved varieties: H series 1,054,000; and A-8 and PTB-16 22,300.

7/ In yala 1970, 22,300 acres were planted to IR-8.

India

1/ Tachung (Native) 1. Hereinafter noted as TN-1. Two kg. were taken to India in a suitcase by the manager of the National Seeds Corporation.

2/ TN-1. One ton was shipped by air freight from IRRI in June 1965. Another 5 tons were received by ship from Taiwan in October 1965.

3/ TN-1. Gift of Joint Commission for Agricultural Reconstruction in Taiwan.

4/ IR-8 (from IRRI). Ten tons was provided by the Ford Foundation and arrived in mid-December 1966. The other ten tons were provided by the Rockefeller Foundation and arrived in Calcutta in February 1967.

5/ Less than 0.1 ton of IR-5 from IRRI in 1968.

Footnotes (cont'd)

SOUTH ASIA (cont'd)

India

6/ Import of less than 0.1 ton each of IR 5-81 and IR 5-114 from IRRI in 1969. (Neither is an official variety, but rather a selection.)

7/ Import of less than 0.1 ton each of IR-20 and IR-22 from IRRI in 1970.

8/ ADT-27.

9/ Composed of 2,500 acres of ADT-27 and 15,150 acres of TN-1. Of the ADT-27 area, 15,000 were in the rabi (or winter season) and 150 in the kharif (or summer season).

10/ Composed of 937,000 acres in rabi season and 1,258,000 in kharif.

11/ Composed of 1,660,000 acres in rabi season and 2,748,000 in kharif.

12/ Composed of 1,935,000 acres in rabi season and 4,690,000 in kharif. Within the rabi season, IR-8 accounted for about 49% of the harvest, TN-1 22%, ADT-27 and others 28% (ref. 7). Two new varieties, Java and Padma, were released (ref. 8).

13/ Official estimate. Earlier estimates placed the kharif figure at 7.57 million acres (ref. 5).

Nepal

1/ Import of IR-5 from IRRI in 1968.

2/ Authorization for India to export "paddy seeds" (presumably IR-8) to Nepal.

3/ Import of 0.32 tons of IR-20 and 0.19 tons of IR-22 from IRRI in 1970.

4/ All improved rice, mainly IR-8 and TN-1. Estimate; exact area not certain.

Footnotes (cont'd)

Pakistan

The seed import data reported separately for East and West Pakistan in the table and in the following sections are not based on IRRI data (which do not differentiate between East and West). Exports made by IRRI are reported as follows:

	IR-8	IR-5	IR-20	IR-22	IR9-60
1966	*				0.22
1967	3.01				
1968	*	*	*		
1969	*	*	4.5 1/	*	
1970					

* Less than 0.1 metric ton.
1/ In addition, 4.4 tons were shipped from commercial sources.

Source: Randolph Barker, IRRI, October 1970.

It will be noted that the 50 ton import reported elsewhere as coming from IRRI in 1967/68 is not included in the IRRI data; the reason for this discrepancy has not been determined.

Pakistan, East

1/ IR-8. Planted during boro (winter) season. (Total seed imports for both East and West Pakistan in 1967 are uncertain: Philippine data (ref. 6) indicate 3,600 tons; the Pakistan data cited here indicate 1,550 tons. The reason for the difference has not been determined.)

2/ IR-20. Received from Philippines in spring of 1970.

3/ Primarily IR-8; some IR-5.

4/ Of this total, about 360,000 acres were in the boro (winter) season. During the aus (spring-summer) season, IR-8 was planted on about 16,000 acres. (Ref. 7).

5/ IRRI and other foreign varieties.

6/ Of this target, 1,016,000 acres are expected to be in the boro season and 200,000 (IR-20) in the aman (summer-fall) season.

Footnotes (cont'd)

SOUTH ASIA (cont'd)

Pakistan, West

1/ IR-8.

2/ IR-8. 50 tons were imported directly from Los Banos. Another 27 tons were forwarded from East Pakistan where they were produced during the 1966/67 season. See East Pakistan fn. 1.

3/ "Few hundred acres."

4/ Includes a "few thousand" acres of IR-6 in the Hyderabad region; this variety is expected to eventually replace IR-8 (ref. 5).

EAST ASIA

Burma

1/ IR-8. Imported from IRRI in 1966.

2/ IR-8. Imported from Philippines in 1967.

3/ IR-8, IR-5. Less than 0.1 ton of each imported from IRRI in 1968.

4/ IR-5. Imported from Philippines in 1969.

5/ IR-20. Imported from Philippines in 1970.

6/ IR-8.

7/ IR-8. In addition, 60 acres of Ngwetoe, an improved local variety, were planted.

8/ IR-8 was planted on 321,600 acres, IR-5 on 11,800, and Ngwetoe on 22,500. In August 1970, C4-63 from the Philippines was being test planted on about 100 acres.

Indonesia

1/ 200 kg. (440 lbs.); introduced from IRRI in 1966. "There have been additional imports of small lots of seed but they have probably not exceeded one metric ton" (ref. 1).

2/ C4-63; developed at the College of Agriculture at the University of the Philippines; imported in first six months of 1968 (ref. 3).

3/ 100 kg. (220 lb.) each of IR-20 and IR-22 were introduced (in January 1969 and February 1970 respectively) with AID assistance.

Footnotes (cont'd)

EAST ASIA (cont'd)

Indonesia

4/ IR-8, IR-5; known locally as PB-8 and PB-5; mostly IR-5 (or PB-5). Also C4-63 in 1969/70. Bimas Baru, Bimas Baru Gotong Rojong, and Inmas Baru Programs.

5/ Of this total, 43,570 acres were in the 1968 dry season and 444,850 were in the 1968/69 wet season. "Only in the 1968/69 wet season did the IRRI varieties, after two years of trials and seed production efforts, begin to be widely used" (ref. 5).

6/ AID's former agricultural officer in Indonesia thinks that this figure is too high and that the actual area was more likely around 1 million acres (ref. 6). Of the reported total, 758,600 acres were in the 1969 dry season and 1,091,800 in the 1969/70 wet season. The total area planted during the wet season, including that planted outside the Bimas and Inmas Programs, is estimated to be "somewhat more" than 1,235,500 acres. The wet season total reportedly includes over 163,000 acres of C4-63 in Central Java alone (ref. 3).

Laos

1/ IR-8. Imported from IRRI in 1966.

2/ Two tons each of IR-5 and IR-253 (a glutinous variety specifically bred to suit taste preferences in the upper Mekong River basin) imported from Philippines in 1968. Two tons of IR-253 from IRRI in 1968.

3/ IR-20 from the Philippines. In addition, less than 0.1 ton each of IR-20 and IR-22 were imported from IRRI.

4/ "Non-photosensitive varieties." Dry season.

5/ IR-8. Of the seasonal total, 500 acres were planted in the wet season and 2,500 in the dry season.

6/ Of the season total, about 1,240 acres were planted in the wet season and 3,760 in the dry season. IR-262 and IR-253 were planted in the wet season, and again in the dry season along with IR-8, IR-5, and C4-63.

7/ Of the seasonal total, about 1,235 acres were planted in the wet season and 3,700 in the dry season. During the wet season, San Pathong (which comes from Thailand) and some IR-253 were planted. During the dry season, IR-253 and C4-63 were planted.

Footnotes (cont'd)

EAST ASIA (cont'd)

Malaysia (West)

1/ IR-8. Imported from IRRI in 1966.

2/ IR-8. Imported from IRRI in 1967.

3/ Less than 1.0 ton each of IR-20 and IR-22 imported from IRRI in 1970.

4/ Includes a number of improved hybrids. About 90% is Mahsuri, which was introduced in January 1965. The remaining 10% is divided between (a) Malinja, which was introduced in early 1950's, and (b) Ria, a local name for IR-8, which was introduced in late 1966. (Refs. 3 and 5.)

5/ IR-8 (Ria) area estimated to be 6,000 acres.

6/ IR-8 (Ria) area estimated to be 8,000 acres.

7/ IR-8 (Ria) area estimated at 3,000 acres. With the introduction of Bahagia (which originated from the same varietal cross as IR-5) in September 1968, Ria and Malinja are expected to decrease in use.

8/ Rough estimate.

Philippines

1/ IR-8. Purchased from IRRI in July 1966 and planted in dry season in late 1966 and early 1967.

2/ 5.2 tons IR-8 and 0.9 tons IR-5 (from IRRI).

3/ 0.1 tons IR-8 and 18.1 tons IR-5 (from IRRI).

4/ Less than 0.1 ton each of IR-8, IR-5, IR-20, and IR-22 from IRRI in 1969.

5/ Composed of 9.5 tons of IR-20 and 24.9 tons of IR-22, both provided by IRRI in 1970. In addition, less than one ton each of IR-8 and IR-5 were also provided by IRRI in 1970.

6/ Bureau of Agricultural Economics data. The total was broken down as follows: IR series 1,082,000 acres; BPI series 629,000; C series 9,000. The BPI series was developed by the Bureau of Plant Industry of the Philippine Government; it is not as high yielding as the other two series. The C series was developed by the College of Agriculture at the University of the Philippines.

EAST ASIA (cont'd)

Philippines

7/ Unofficial estimate. The estimate of the Bureau of Agricultural Economics was 3,155,000 acres (ref. 5), but this seems too high in terms of (a) the figures for the previous and subsequent year (the area devoted to HYV's was to have increased about 20% in 1969/70; ref. 7), and (b) another estimate available for the same year (the National Food and Agricultural Council placed the area at 1,482,600 acres (ref. 6) or 41% less than the area reported in the table and 53% less than the BAE figure just noted). The BAE figure was broken down as follows: IR series 2,223,000 acres; BPI series 723,000; and C series 209,000.

8/ Bureau of Agricultural Economics data. The National Food and Agricultural Council places the area at 2,347,500 acres, or about 30% less (ref. 7). The BAE data were broken down as follows: IR series, 2,562,900 acres; BPI series, 283,200; and C series, 499,500.

Vietnam (South)

1/ IR-8; imported in October 1967. This shipment is noted in an AID report (ref. 1) but not in IRRI listings (which cite only shipments of less than 0.1 ton of IR-8 and IR-5; ref. 6).

2/ 2,000 tons of IR-8, 5 tons of IR-5. Barker indicates that the Philippines exported 1,807 tons of IR-8 and 205 tons of IR-5 to Vietnam (ref. 6). The reason for the difference in varietal composition is not known at this point.

3/ 143 lbs. (65 kg.) of IR-20 received from IRRI in June 1969.

4/ IR-22 from IRRI, 1970. In addition, less than 0.1 ton of IR-20 seed was received from IRRI.

5/ Area planted. Only about 330 acres were harvested because of poor rains.

6/ The goal was 109,000 hectares. Estimates of achievement range from 90 to 100%.

7/ Target.

C. REFERENCES

SOUTH ASIA

Ceylon

(1) Randolph Barker, "Economic Aspects of High-Yielding Varieties of Rice, with Special Reference to National Price Policies," Monthly Bulletin of Agricultural Economics and Statistics, June 1969, pp. 1-2.

(2) Data provided by Dr. Randolph Barker, International Rice Research Institute, October 23, 1970.

(3) Letter from H. L. Dwelly, Acting Aid Representative, American Embassy, Colombo, October 2, 1969 (data supplied in response to request sent to L.N. Bandaranaike, Director of Agricultural Development, Ministry of Agriculture and Food).

(4) Letter from C. Weerasinghe, Assistant Director of Agricultural Development, Ministry of Agriculture and Food, to US AID, Colombo, October 16, 1970 (forwarded by Michael H. Snyder, Assistant AID Representative, October 21, 1970).

(5) Data supplied by the Ministry of Agriculture and Lands, December 10, 1970 (forwarded by Snyder, December 14, 1970).

India

(1) Carroll P. Streeter, A Partnership to Improve Food Production in India, The Rockefeller Foundation, 1969 or 70, pp. 26-29.

(2) Ibid.; letter from Streeter, April 14, 1970; letter from Randolph Barker, IRRI, March 31, 1970.

(3) Barker (October 1970).

(4) "Rice Crop Proves Tanjore Program's Worth," Foreign Agriculture, March 4, 1968, p. 7; Department of State Airgram A-44 from Madras, October 13, 1967.

(5) Foreign Agricultural Service Report IN0143 from New Delhi, October 20, 1970 (data from Directorate of Extension, Ministry of Food and Agriculture).

(6) Foreign Agricultural Service Telegram TOFAS 07 from New Delhi, January 13, 1971.

(7) "Evaluation Study of High Yielding Varieties Programme, Report for the Rabi 1968-60 - Wheat, Paddy, and Jowar," Planning Commission, New Delhi, November 1969, p. 50.

References (cont'd)

SOUTH ASIA (cont'd)

India

(8) Guy L. Haviland, "Promising New Varieties still Face Problems," Foreign Agriculture, December 22, 1969, p. 21; "New Rice Varieties for India," World Farming, June 1970.

Nepal

(1) Barker (October 1970).

(2) Department of State Telegram 6779 from New Delhi. (Reply in Telegram 80722 to New Delhi, May 29, 1969.)

(3) Letter from Dale G. Strong, Food and Agriculture Division, AID, Kathmandu, September 12, 1969 (data from Agriculture Extension Department of Nepalese Government).

(4) Department of State Telegram 4147 from Kathmandu, December 24, 1970.

Pakistan, East

(1) Letter from Leon F. Hesser, Assistant Director of Agricultural Policy, AID, Rawalpindi, October 9, 1969.

(2) "Rice and Wheat in Pakistan," Spring Review (AID), March 17, 1969, pp. 2-5.

(3) "Country Field Submission: Pakistan, FY 1971," AID, August 1969, Appendix A, Table 1; letter from Carl O. Winberg, Agricultural Attache, American Embassy, Rawalpindi, October 7, 1969.

(4) Foreign Agricultural Service Telegram TOFAS 96 from Rawalpindi, October 15, 1969 (official estimate by Government of Pakistan).

(5) "Notification," Government of Pakistan, Ministry of Agriculture and Works, Islamabad, November 11, 1970, p. 1. (Enclosure to Foreign Agricultural Service Report PK0091 from Islamabad, November 24, 1970.)

(6) Barker, op. cit. (June 1969).

(7) Department of State Airgram TOAID A-461 from Rawalpindi September 16, 1970 (PROP), pp. 5, 6, 13.

References (cont'd)

SOUTH ASIA (cont'd)

Pakistan, West

(1) "Rice and Wheat in Pakistan," op. cit., pp. 16-17.

(2) Letter from Hesser, op. cit.

(3) Telegram TOFAS 96, op. cit.

(4) "Notification", op. cit.

(5) Foreign Agricultural Service Report PK-9095 from Rawalpindi, August 5, 1969.

EAST ASIA

Burma

(1) Barker, op. cit. (June 1969). Also see Gladys Charitz, "Rice Surplus Affirms Success," Journal of Commerce, March 29, 1968.

(2) Barker (October 1970).

(3) Official sources, August 4, 1970.

Indonesia

(1) Letter from Francis J. LeBeau, Chief, Agriculture Division, AID, Djakarta, September 30, 1969. (Data obtained from Ministry of Agriculture of the Government of Indonesia.)

(2) Barker, op. cit. (June 1969).

(3) James E. Hawes, "Rice in Indonesia," Agriculture Division, AID, Djakarta, May 1970, pp. 18, 19.

(4) Letter from John W. Shotwell, Marketing Advisor, Agriculture Division, AID, Djakarta, November 4, 1970. (Data from Ministry of Agriculture.)

(5) Kampto Utomo, "Indonesia," Regional Seminar on Agriculture: Papers and Proceedings, Asian Development Bank, Manila, 1969, p. 161.

(6) Conversation with LeBeau (op. cit.), Washington, November 20, 1970.

References (cont'd)

EAST ASIA

Laos

(1) Barker (June 1969).

(2) Barker (October 1970).

(3) Department of State Airgram TOAID A-647 from Vientiane, August 15, 1969.

(4) Letter from Leroy H. Rasmussen, Agriculture Division, AID, Vientiane, September 12, 1969.

(5) Letter from Rasmussen, op. cit., September 23, 1970.

Malaysia (West)

(1) Barker (June 1969).

(2) Barker (October 1970).

(3) Letter from Dale K. Vining, Agricultural Attache, American Embassy, Kuala Lumpur, September 4, 1969 (estimate made by attache's office).

(4) Foreign Agricultural Service Telegram TOFAS 72 from Kuala Lumpur, December 17, 1970 (in response to FASTO 64, December 16).

(5) Foreign Agricultural Service Reports from Kuala Lumpur: AGR-40, March 2, 1964; AGR-36, January 1, 1965; AGR-7, August 19, 1966; AGR-69, September 10, 1968.

Philippines

(1) Barker (June 1969).

(2) Barker (October 1970).

(3) "Rice in the Philippines," Spring Review (AID), March 3, 1969, section 2, p. 6, Appendix Table VIII-B. Data from RCPCC.

(4) Letter from Randolph Barker, IRRI, October 21, 1969.

(5) Telegram from Randolph Barker, IRRI, December 14, 1970; letter from Barker, December 15, 1970.

(6) Letter from John T. Hopkins, Assistant Agricultural Attache, American Embassy, Manila, September 25, 1970.

(7) Foreign Agricultural Service Telegram TOFAS 70 from Manila, December 3, 1970.

References (cont'd)

EAST ASIA (cont'd)

Vietnam (South)

(1) "Rice in South Vietnam," Spring Review (AID), March 12, 1969 (TOAID A-1357), pp. 2, 8, 15, 16, 17.

(2) Agricultural Production Memo, Rice Series No. 117, Office of Domestic Production, US/AID, Saigon, January 6, 1970. Also noted in Department of State Airgram TOAID A5406 from Saigon, October 31, 1970, p. 5.

(3) Barker (October 1970).

(4) William J.C. Logan, "Changes in South Vietnamese Agriculture Raise Farm Production and Profits to New Levels," Foreign Agriculture, October 12, 1970, p. 9. (Slight adjustments in data in accordance with subsequent discussion with Logan.)

(5) Agricultural Production Memo, Rice Series No. 134, Office of Domestic Production, US/AID, Saigon, November 9, 1970.

(6) Barker (June 1969).

A. HIGH-YIELDING WHEAT

	1965/66	1966/67	1967/68	1968/69	1969/70 1/
			-- acres --		
South Asia					
Afghanistan	-	4,500	54,400	301,500	360,800
India	7,400	1,270,000	7,270,000	11,844,000	15,100,000
Nepal	3,500	16,200	61,300	133,000	186,500
Pakistan (E)	-	-	-	20,000	NA
Pakistan (W)	12,000	250,000	2,365,000	5,900,000	7,000,000
West Asia					
Iran	-	-	-	25,000	222,400
Jordan	-	-	-	230	-
Lebanon	-	-	-	690	4,200
Turkey	-	1,500	420,000	1,430,000	1,540,000
Africa					
Algeria	-	-	-	-	12,400
Morocco	-	-	500	12,100	98,800
Tunisia	-	-	2,000	32,000	131,000
Latin America					
Guatemala	-	-	-		7,400
Total	22,900	1,542,200	10,173,200	19,698,520	24,663,500

1/ Preliminary.

B. HIGH-YIELDING RICE

	1965/66	1966/67	1967/68	1968/69	1969/70 1/
			-- acres --		
South Asia					
Ceylon 2/	-	-	-	17,200	65,100
India 3/	17,650	2,195,000	4,408,000	6,625,000	10,800,000
Nepal	-	-	-	105,000	123,000
Pakistan (E)	-	500	166,000	381,500	651,700
Pakistan (W)	-	200	10,000	761,000	1,239,000
East Asia					
Burma	-	-	8,500	412,400	355,900
Indonesia	-	-	-	488,400	1,850,400 4/
Laos	-	900	3,000	5,000	4,900
Malaysia (W)	-	104,500	157,000	224,700	316,000
Philippines 3/	-	204,100	1,733,400	2,500,000 4/	3,345,600
Vietnam (S)	-	-	1,200	100,000	498,000
Total	17,650	2,505,200	6,487,100	11,620,200	19,249,600

1/ Preliminary.
2/ Excludes improved local varieties.
3/ Includes improved local varieties.
4/ There is particular uncertainty concerning this figure (see footnotes).

C. ESTIMATED TOTAL AREA OF HIGH-YIELDING VARIETIES OF WHEAT AND RICE

Crop Year	Wheat 1/	Rice 2/	Total
		-- acres (rounded) --	
1965/66	23,000	18,000	41,000
1966/67	1,542,000	2,505,000	4,047,000
1967/68	10,173,000	6,487,000	16,660,000
1968/69	19,699,000	11,620,000	31,319,000
1969/70 3/	24,664,000	19,250,000	43,914,000
		-- hectares (rounded) --	
1965/66	9,000	7,000	16,000
1966/67	624,000	1,014,000	1,638,000
1967/68	4,117,000	2,625,000	6,742,000
1968/69	7,972,000	4,703,000	12,675,000
1969/70 3/	9,982,000	7,790,000	17,772,000

1/ Excluding Mexico.

2/ Excluding improved local varieties in Ceylon and Taiwan but including improved local varieties developed in India and the Philippines.

3/ Preliminary.

Conversions on basis of 1 acre = .4047 hectares.

D. ESTIMATED TOTAL HARVESTED AREA OF ALL VARIETIES OF WHEAT AND RICE 1/

	1963/64 to 1967/68 avg.	1969/70 Preliminary
	---acres---	
I. WHEAT		
SOUTH ASIA		
Afghanistan	5,720,000	NA
India	33,334,000	39,536,000
Nepal	314,000	959,000
Pakistan 2/	13,410,000	15,367,000
WEST ASIA		
Iran	5,140,000	11,614,000
Jordan	603,000	618,000
Lebanon	148,260	148,260
Turkey	18,518,000	20,015,000
AFRICA		
Algeria	4,880,000	NA
Morocco	4,238,000	4,643,000
Tunisia	2,224,000	1,853,000
II. RICE		
SOUTH ASIA		
Ceylon	1,546,000	1,657,000
India	89,271,000	93,900,000
Nepal	2,764,000	2,900,000
Pakistan 3/	26,897,000	29,840,000
EAST ASIA		
Burma	12,241,000	12,400,000
Indonesia	19,640,000	19,700,000
Laos	1,546,000	1,900,000
Malaysia (West)	978,000	1,300,000
Philippines	7,927,000	7,660,000
Vietnam (South)	5,842,000	6,225,000

1/ The data listed here for all varieties are not necessarily taken from the same sources as those used for the high-yielding varieties and therefore may not be strictly comparable. "Harvested area as far as possible."

2/ Virtually all wheat production is in West Pakistan.

3/ Most of the rice area (about 85%) is in East Pakistan.

Source: Wheat. Foreign Agriculture Circular F6 23-70, October 1970.
Rice. World Agricultural Production and Trade, December 1970, p. 31; and other sources.

VI. APPENDIX: RICE IMPROVEMENT IN COMMUNIST NATIONS

A. Mainland China

Mainland China has long been the world's largest rice producer. Accordingly, it has an extended history of rice improvement. 1/ As with other countries, much of this involved simple selection of improved varieties by farmers which were then used locally.

Perhaps the most significant early step of which we have record took place around 1000 A.D. A new rice, known as Champa, was introduced from Indo-China into Fukien, and after 1012, into the lower Yangtze and lower Huai areas. Champa had several outstanding features: it was relatively early ripening (100 days after transplanting) and drought resistant. Although indigenous early-ripening rices had been in use previously, their adoption was very limited. Following the introduction of Champa, however, the use of early-ripening rice expanded, especially in southeast China. Other shorter season varieties were developed in the eleventh and twelfth centuries. By the early 1830's it is estimated that the area under early maturing varieties exceeded that under traditional types. While most were probably used for early season planting, thereby allowing double cropping, some were used to plant after severe droughts or floods. 2/

Both Indica and Japonica rices (see Chapter II) are found in Mainland China. Most of the varieties grown in southern China have traditionally been Indicas. Both Indica and Japonica varieties have been reported growing in the area bordering the Yangtze River in central China. 3/

Irrigation and fertilization of rice have long been practiced in China. 4/ Through most of history, the fertilizers were organic products such as grasses, fish cakes and night soil. The development of quick acting chemical fertilizers promised a much sharper boost for varieties

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1/ Dwight H. Perkins, "Improved Seed," in his Agricultural Development in China, 1368-1968, Aldine, Chicago, 1969, pp. 38-41. A partial tabulation documents the introduction of over 200 varieties from 1500 to 1740 and a like amount for the 1740 to 1920 period (p. 40).

2/ Ping-ti Ho, "Early Ripening Rice in Chinese History," The Economic History Review, December 1956, pp. 200-216. The origins of rice in China are discussed by Ho in "The Loess and the Origin of Chinese Agriculture," American Historical Review, October 1969, pp. 19-26.

3/ Takane Matsuo, Rice and Rice Cultivation in Japan, Institute of Asian Economic Affairs, Tokyo, 1961, pp. 11, 13, 19.

4/ Perkins, op. cit., pp. 60-76.

which could respond to their application and yet not lodge. 5/ Such fertilizers, however, did not begin to be very widely adopted in Mainland China until the 1960's. 6/

Stalk strength is a particularly important factor in the southern portions of China, especially in Kwangtong Province, because the early crop matures during the first part of the typhoon season. According to the Kwangtung Agricultural Science Academy, six strains of dwarf rice were successfully developed during the period from 1959 to 1963. 7/ Distribution of a dwarf "Nanteh" variety (I-geo Nan-teh) began in 1961. Large scale dissemination began in 1964 and it is claimed that nearly a million acres in Kwangtung, or about half the total early rice area, was sown to dwarf strains in that year. In 1965, the proportion increased to more than 80%. Today dwarf varieties are reportedly extensively used in all early rice producing provinces (the area of early rice accounts for about one quarter of the total rice output in China). 8/

A recent survey of Chinese agriculture broadcast over Hanoi Radio stated that five provinces had "popularized cultivation of a kind of rice plant whose stalk is small, which has few leaves, will rarely collapse prematurely but whose production is high". 9/ A radio broadcast from Nanchang described a similar short-stemmed strain which produced twice the usual yields. 10/ Travelers to a commune in Kwangtung in December 1969 re-

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5/ In Japan, increasing application of commercial fertilizer (fishmeal, soybean cakes) in the late 1800's and chemical fertilizer in the early 1900's led to an early interest in the development of such varieties. One of the first was selected in 1877. (Takane Matsuo, Rice Culture in Japan, Yokendo Ltd., Tokyo, 1955, p. 13.)

6/ Perkins, op. cit., pp. 60-76. A new chemical fertilizer known as 702 has recently been popularized in Kwangtung Province ("702 - Chinese Puzzle," Economic Times of India, Bombay, November 3, 1970).

7/ By 1966, nine improved dwarf varieties had been introduced in Kwangtung (memo from T.T. Chang, International Rice Research Institute, October 20, 1970). It is reported that at least some of the short stalk strains were developed in eastern Kwangtung, a well-known high-yield rice area, from a parent species native to Fukien Province. Similarly, to the immediate north in Kiangsi Province, a short-stemmed rice (Bantam Nan No. 4) was introduced from Fukien in early 1964. Dee-geo-woo-gen, one of the parents of TN-1 and IR-8, is thought to have come from Fukien.

8/ Based on comments provided by Yueh Tung, Office of the Agricultural Officer, American Consulate General, Hong Kong, September 23, 1970.

9/ Tillman Durdin, "Chinese Report New Rice Strain," New York Times, October 26, 1969.

10/ "Two Big Harvests Reported in China," New York Times, October 26, 1969.

ported that a short rice crop had been planted and was very satisfactory. Record rice yields were reported obtained in China in 1969 and were attributed to the introduction of new varieties. 11/

It is a tantalizing question whether the IRRI varieties have played any role in recent Chinese developments. On one hand, the Chinese could well have developed their own high-yielding dwarf varieties without making use of outside seed stock. On the other hand, it would seem highly likely that the Chinese would have imported IR-5 and IR-8 for experimental purposes (even though south China might be too far north for optimum performance). The Chinese have said nothing on this question. 12/

Western news accounts are mixed. Several point out the similarities between the IRRI and Chinese varieties but go no further. 13/ Only one news account is known to have actually said that IR-8 is being used in China; it indicated that the Chinese began their first experiments with the seed in 1968 and then placed orders for seed through proxies in Nepal and Pakistan for spring planting in 1970. 14/

On balance, it would seem very likely that the Chinese have imported at least small quantities of IRRI seed. But whether the seed has been imported in large quantities and/or has had any significant impact to date is not at all certain and may never be. The more important questions, however, concern the increased yield potential and area devoted to the new varieties, whatever their origin. And on these points we seem to have little solid information as yet.

11/ Ibid. No one variety has been named; it is likely that at least several are involved.

12/ Considerable official emphasis has, however, been placed on shortening the time involved in developing new varieties. Plant breeders have been sent to the countryside for "re-education." In the process, long-term breeding projects have likely been broken up. (See, for example, "Scientists Cultivate New Seed Varieties," New China News Agency, December 11, 1969; reported in FBIS, December 12, 1969.)

13/ One said in print that the Chinese were using the varieties but the author indicates that a typographical error was made in composing and a critical "not" was left out (Lee Lescaze, "Fat Grain Harvest Rewards Red China's Agricultural Push", Washington Post, August 2, 1970; letter from Lescaze, Hong Kong, September 7, 1970).

14/ Richard Hughes, "China Samples the Rockefeller Rice", London Sunday Times, February 15, 1970 (reprinted as "Superior Rice Strain is Sold to Red China", Chicago Tribune, May 6, 1970). Hughes subsequently indicated (September 21) that he had confirmed the report with a contact in Peking.

B. North Vietnam*

Short-stemmed spring rice varieties were introduced to the mountain areas of North Vietnam from Mainland China during the Indo-China war. They were adopted because they could grow rapidly under rather hostile weather conditions.1/ Following the departure of the French, these varieties reportedly began to move into the delta area. 2/ A recent broadcast on Hanoi Radio indicated that while the spring rice had been transplanted for about 10 years,"we are not yet familiar with it." 3/

The total area of spring rice has reportedly expanded as follows: 1968, 148,000 acres; 1969, 274,000; 1970, 500,000 4/. In 1969, spring rice accounted for about 17% of the total area of the winter-spring rice crop (which in turn represents about 1/3 of the total annual rice area). In 1970 the proportion was expected to increase to about 33%. 5/

While there are several spring varieties, two may be of special interest: "Agricultural 8" and "Agricultural 5." According to a Vietnamese account in September 1969, "With the spring rice, we will be able to adopt many more valuable varieties such as Agricultural 8 and Agricultural 5, which... we are growing experimentally over large areas." 6/

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* Also see Anthony M. Riccio Jr., "Seventeen Years of Agricultural Development, North Vietnam, 1954-1970," New York University, Department of Economics, MA thesis, January 1970 (on file in FEDS library).

1/ "Spring Rice Has Good Prospects in Vietnam," Khoa Hoc Thuong Thuc (Hanoi, in Vietnamese), No's. 321 and 323, February and March 1970 (JPRS 50693, June 9, 1970).

2/ Nguyen Van Luat, "Prospects for Short-Term Rice in Vietnamese Agriculture," To Quoc (Hanoi), September 1969, pp. 24-26 (JPRS 49482, December 19, 1969).

3/ "5th-Month and Spring Paddy Crops," Hanoi Domestic Service, September 17, 1970 (FBIS, Vol. IV, No. 184, September 22, 1970). Partially summarized in "Miracle Rice Narrows Food Gap in North Vietnam," The Sun (Baltimore), September 29, 1970.

4/ Van Luat, op. cit. The article suggested that the area would be 741,000 acres in 1970, but in reality it seems to have been closer to 500,000.

5/ "5th-Month and Spring Paddy Crops," op. cit.

6/ Van Luat, op. cit.

C. Cuba

IR-8 rice is widely planted in Cuba and evidently is doing quite well. Of 256,700 acres of rice planted in the "spring campaign" as of late May 1970, 91% was reportedly IR-8. 1/ (It is not yet known what proportion of subsequent plantings was IR-8.)

Details for some of the leading regions follow. In the Jibaro area, about 30,000 acres (out of a total of 40,000) were sown to IR-8 in the spring of 1969. 2/ During the same season, IR-8 was "used in most of the planting" (which totaled 83,500 acres) in Oriente Province; 3/ similarly, in 1970 "a good share of the rice fields in Oriente are planted in variety IR-8 from the Philippines." 4/ During the 1969/70 season, 66,400 acres were planted to IR-8 and 2,300 acres to IR-160 in Matanzas. 5/

Just when and how Cuba obtained IR-8 seed has not been reported. The International Rice Research Institute has not reported shipments from the Philippines to Cuba. A Cuban newspaper account in December 1968 said only that the seed was obtained after much difficulty ("y que Cuba obtuvo venciendo innumerables dificultades."). 6/ Production of certified seed is scheduled to begin during the winter of 1970/71.

1/ "The Spring Campaign Reaches 7,663 Caballerias of Rice," Granma (Havana, in Spanish), June 1, 1970.

2/ Aldo Isidron del Valle, "Rice Production to Increase in Jibaro Area," Granma, May 13, 1969, p. 5.

3/ Lenzano Paneque, "Oriente Rice Harvest," Granma, October 2, 1969, p. 1.

4/ Daniel Torres, "Rice in the Economic Program of Oriente Province," Havana Radio, January 1, 1970 (JPRS 49647, January 20, 1970).

5/ Juan Varela Perez, "How is the Rice Plan in Matanzas Going?" Granma, January 5, 1970.

6/ Rene Camacho Albert, "Rice Plan, Self Sufficiency in 1971 in Oriente," Granma, December 21, 1968, p. 5.